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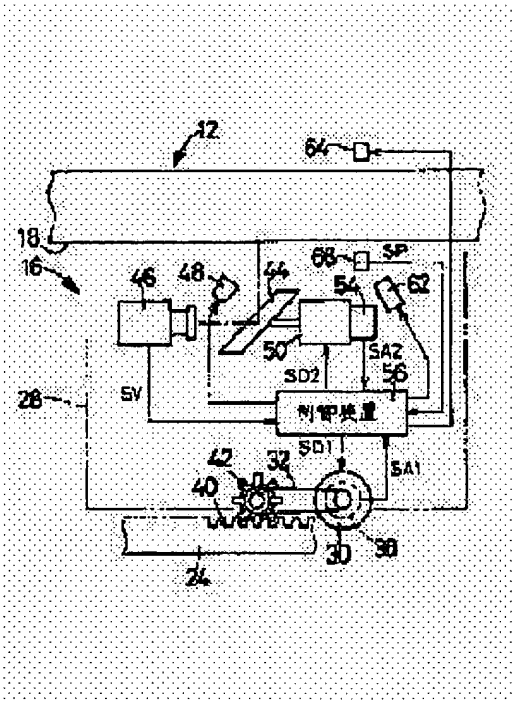
(54) AUTOMATIC FLAW DETECTOR WITH FLUORESCENT MAGNETIC POWDER

(57)Abstract:

PURPOSE: To maintain high flaw detecting performance even if a scattering amount of fluorescent magnetic powder, intensity of an ultraviolet ray, etc., are varied by deciding a flaw decision threshold value based on an average value of signal intensity of an image signal.

CONSTITUTION: A controller 56 inputs an image signal SV from a TV camera 46, and sets a flaw detecting area of only a surface 18 to be flaw-detected of a material 12 to be inspected. The signal SV is smoothed with respect to a longitudinal direction of the material 12 to remove noise. An average value Iav of a signal intensity I of the signal SV in the area is calculated, and a value of, for example, 2-4 times as large as it is set to a flaw decision threshold value TH based on the value Iav. It is differentiated with respect to a lateral direction of the material 12 to abruptly vary a change in the intensity I to sharpen the image. The intensity I is compared with the value TH, a part of I>TH is extracted as a flaw candidate, part to be considered to be noise is removed therefrom, the flaw candidate after removing is judged as the flaw. The value TH is varied in response to the change in the intensity I of the signal SV is varied to always judge presence/absence of the flaw accurately.



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* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to amelioration of the fluorescence magnetic powder type automatic-testing equipment which detects the existence and the blemish location of a surface crack automatically by picturizing the pattern of the fluorescence magnetic powder which adhered on the surface of inspected material, and performing an image processing.
[0002]
[Description of the Prior Art] There is a fluorescence magnetic particle examination as a means to detect the surface crack of inspected material, such as steel. Since it will emit light strongly in the blemish portion if inspected material is magnetized while this adheres fluorescence magnetic powder by the shower or Myst, DOBU ****, etc. on the surface of inspected material, and magnetic powder irradiates a meeting and ultraviolet rays by the leakage flux by the surface crack at a blemish portion, it gets to know the existence and the location of a blemish from the condition (magnetic particle pattern) of the luminescence. And the automatic-testing equipment which detected the existence and the location of a blemish automatically is known by picturizing this magnetic particle pattern with image pick-up equipment, and comparing with the blemish decision threshold which was able to define the picture signal beforehand. Moreover, to the inspected material of long pictures, such as steel, the inspected material or the above-mentioned image pick-up equipment is moved to a longitudinal direction, and the front face of inspected material is divided into two or more blocks, and carries out flaw detection. The automatic-testing equipment indicated by Japanese Patent Application No. No. 100425 [four to] for which these people applied previously is the example.
[0003]
[Problem(s) to be Solved by the Invention] By the way, if the irrelevance and concentration of the above-mentioned fluorescence magnetic powder vary or aging is carried out, the luminescence reinforcement of a blemish portion, and since the signal strength of a picture signal changes further, the detection precision of a blemish will fall. It is also the same as when the reinforcement of ultraviolet rays changes by deterioration of a lamp etc. For this reason, in order to maintain the fixed flaw detection engine performance, irrelevance, ultraviolet-rays reinforcement, etc. of fluorescence magnetic powder needed to be measured periodically, and it etc. needed to be managed severely.
[0004] Moreover, even if it was inspecting magnetic powder irrelevance, ultraviolet-rays reinforcement, etc. periodically as mentioned above, it could not respond to sudden change by clogging of a nozzle, a lamp piece of ultraviolet rays, etc. which sprinkle fluorescence magnetic powder, but was left as it is till the next periodic check, and the serious surface crack may have been overlooked. Although there is also the method of monitoring magnetic powder irrelevance, ultraviolet-rays reinforcement, etc. continuously, in order to supervise the nozzle of a large number which sprinkle fluorescence magnetic powder, for example to long steel etc., while much supervisory equipment is required and flaw detection equipment becomes large-scale as a whole, there are problems, like cost becomes high.
[0005] It is that succeeded in this invention against the background of the above situation, and the 1st

object enables it to maintain the high flaw detection engine performance even if irrelevance, ultraviolet-rays reinforcement, etc. of fluorescence magnetic powder change, and the 2nd object is to enable it to detect simply and promptly abnormalities, such as magnetic powder irrelevance and ultraviolet-rays reinforcement.

[0006]

[The 1st means for solving a technical problem] An exposure means to irradiate ultraviolet rays on the front face of inspected material on which the 1st invention is for attaining the 1st object of the above, and it adhered to (a) fluorescence magnetic powder, In the fluorescence magnetic powder type automatic-testing equipment which has a blemish decision means to judge the existence of the blemish of said front face for the signal strength of the picture signal as compared with a blemish decision threshold (b) -- the image pick-up equipment which picturizes the front face and outputs a picture signal, and (c) -- (d) -- an operation means to calculate the average of the signal strength of said picture signal, and (e) -- it is characterized by having a threshold decision means to determine said blemish decision threshold based on the average calculated by the operation means.

[0007]

[An operation and effect] of the 1st invention In such fluorescence magnetic powder type automatic-testing equipment, while the average of the signal strength of a picture signal is calculated by the operation means, a blemish decision threshold is determined by the threshold decision means based on the average, and the existence of a surface crack is judged by measuring the blemish decision threshold and signal strength of a picture signal. For this reason, it originates in change of the irrelevance of fluorescence magnetic powder, ultraviolet-rays reinforcement, etc., and the luminescence reinforcement of the whole front face of inspected material, and when the signal strength of the whole picture signal changes further, a blemish decision threshold also changes with a change of that picture signal on the strength, and the existence of a blemish can be judged in an always high precision.

[0008]

[The 2nd means for solving a technical problem] An exposure means to irradiate ultraviolet rays on the front face of inspected material on which the 2nd invention is for attaining said 2nd object, and it adhered to (a) fluorescence magnetic powder, In the fluorescence magnetic powder type automatic-testing equipment which has a blemish decision means to judge the existence of the blemish of said front face for the signal strength of the picture signal as compared with a blemish decision threshold (b) -- the image pick-up equipment which picturizes the front face and outputs a picture signal, and (c) -- (d) -- an operation means to calculate the average of the signal strength of said picture signal, and (e) -- it is characterized by having an abnormality decision means to judge the abnormalities of flaw detection conditions based on the average calculated by the operation means.

[0009]

[An operation and effect] of the 2nd invention In such fluorescence magnetic powder type automatic-testing equipment, the average of the signal strength of a picture signal is calculated by the operation means, and the abnormalities of flaw detection conditions, such as irrelevance, ultraviolet-rays reinforcement, etc. of fluorescence magnetic powder, are judged by the abnormality decision means based on the average. If irrelevance, ultraviolet-rays reinforcement, etc. of fluorescence magnetic powder change, it will follow on it. Namely, since [the luminescence reinforcement of the whole front face of inspected material, since the signal strength of the whole picture signal changes further], It can be judged as if there is less irrelevance of fluorescence magnetic powder than usual when the average of the signal strength is lower than the reference value defined beforehand, for example, or when extremely lower than the average of the signal strength at the time of the last flaw detection, the thing which has those abnormalities when ultraviolet-rays reinforcement is weak.

[0010] Thus, since abnormalities, such as magnetic powder irrelevance and ultraviolet-rays reinforcement, are promptly [simply and] detectable based on the signal strength of a picture signal according to the 2nd invention, overlooking of this surface crack that originates unusually etc. can be prevented good, and reliability improves. Moreover, since large-scale monitor equipment is not needed, while flaw detection equipment is constituted compactly and cheaply as a whole, the burden of

operators, such as a periodic check, is mitigated.
[0011]
[The 3rd means for solving a technical problem] An exposure means to irradiate ultraviolet rays on the front face of inspected material on which the 3rd invention is for attaining said 1st and 2nd objects, and it adhered to (a) fluorescence magnetic powder, In the fluorescence magnetic powder type automatic-testing equipment which has a blemish decision means to judge the existence of the blemish of said front face for the signal strength of the picture signal as compared with a blemish decision threshold (b) -- the image pick-up equipment which picturizes the front face and outputs a picture signal, and (c) -- (d) -- an operation means to calculate the average of the signal strength of said picture signal, and (e) -- with an abnormality decision means to judge the abnormalities of flaw detection conditions based on the average calculated by the operation means (f) It is characterized by having a threshold decision means to determine said blemish decision threshold based on the average calculated by said operation means.
[0012]
[An operation and effect] of the 3rd invention Namely, this 3rd invention is what combined said 1st invention and 2nd invention. While the abnormalities of flaw detection conditions were judged while determining the blemish decision threshold based on the average of the signal strength of a picture signal, and being able to carry out flaw detection in a precision always high irrespective of the abnormalities of flaw detection conditions, such as irrelevance, ultraviolet-rays reinforcement, etc. of fluorescence magnetic powder The abnormalities of the flaw detection condition can be detected now simply and promptly, and the reliability of equipment improves substantially.
[0013]
[The 4th means for solving a technical problem] The image pick-up equipment which is made to carry out relative displacement of the 4th invention to the longitudinal direction of the inspected material of the long picture in which it is for attaining said 1st and 2nd objects, and the (a) front face adhered to fluorescence magnetic powder, and divides and picturizes said front face to two or more blocks, (b) An exposure means to be made to carry out relative displacement to the image pick-up equipment to said inspected material in one, and to irradiate ultraviolet rays on said front face, (c) In the fluorescence magnetic powder type automatic-testing equipment which has a blemish decision means to judge the existence of the blemish of said front face for the signal strength of the picture signal outputted for every block from said image pick-up equipment as compared with a blemish decision threshold (d) An operation means to calculate the average of the signal strength of said picture signal in every block, (e) A threshold decision means to determine said blemish decision threshold for every block based on the average value calculated by the operation means, (f) A 1st abnormality decision means to judge the abnormalities of flaw detection conditions for the average of each block searched for by said operation means as compared with mutual, (g) It is characterized by having a 2nd abnormality decision means to judge the abnormalities of flaw detection conditions by comparing with the reference value which averaged the average of each block searched for by said operation means, and was set up beforehand.
[0014]
[An operation and effect] of the 4th invention This 4th invention carries out relative displacement of that inspected material and image pick-up equipment to the longitudinal direction of long inspected material, divides and carries out flaw detection of the front face of inspected material to two or more blocks, determines a blemish decision threshold in quest of the average of the signal strength of a picture signal for every block, and judges the existence of a blemish based on that blemish decision threshold. Even when it follows, for example, unevenness is in the irrelevance and concentration of fluorescence magnetic powder and flaw detection conditions differ in one inspected material, flaw detection can be performed in an always high precision.
[0015] Moreover, since the abnormalities of flaw detection conditions are judged for the average of the signal strength in each above-mentioned block as compared with mutual, for example, when fluorescence magnetic powder is being sprinkled using many nozzles, that the nozzle which has abnormalities, such as clogging, by this abnormality decision can be specified etc. can reach to an extreme of the abnormalities of magnetic powder adhesion equipment or a UV irradiation means, and it

can detect finely it. [it] The average of the signal strength in each block is averaged, since the abnormalities of flaw detection conditions are judged also by comparing with the reference value set up beforehand, it can respond also to long-term change of flaw detection conditions, such as deterioration of an ultraviolet ray lamp, and it is possible to judge the abnormalities of flaw detection conditions certainly, and high reliability is acquired.

[0016]

[Example] Hereafter, one example of this invention is explained to details based on a drawing.

[0017] Drawing 1 is the perspective diagram of the fluorescence magnetic powder type automatic-testing equipment (only henceforth flaw detection equipment) 10 which is one example of this invention, and it is drawing where drawing 2 explains the cross section and drawing 3 explains a control system. abbreviation in which the inspected material 12 which is steel made from a ferromagnetic had the rectangular cross section, and has constituted the shape of a long picture in drawings, such as this, and the ridgeline of a longitudinal direction is located vertically and horizontally by two or more examining table 14 -- it is supported by location immobilization with the level position. And the blemish which exists on the surface of [18 (2nd upper page)] a periphery is detected by the inspection unit 16 of a couple moved to the longitudinal direction of the inspected material 12. A magnetic particle examination is a method of making the magnetic powder which is the powder of a ferromagnetic sticking to the blemish portion intensively, and investigating the existence and the location of a blemish from the magnetic particle pattern by the magnetic leakage flux which bypasses the blemish a front face or near the front face (defect), and flows, and while the above-mentioned inspected material 12 is beforehand exposed to a magnetic field and being magnetized, the front face 18 adheres to fluorescence magnetic powder by spraying, DOBU ****, etc. by many nozzles.

[0018] The guide rails 24 and 26 of a couple are arranged in the longitudinal direction of that inspected material 12, and parallel, and said inspection unit 16 covers the overall length of inspected material 12, and has come to be able to carry out flaw detection above inspected material 12 by being arranged in the truck 28 it runs by being supported by the guide rails 24 and 26 of this couple. The servo motor 30 by which revolution actuation is carried out is arranged in this truck 28 by the driving signal SD 1 supplied from a control unit 56 to positive reverse both directions, and a truck 28 is run guide-rail 24 and 26 top with the predetermined passing speed V by transmitting the driving force of this servo motor 30 to driving wheels 34 and 36 through a timing belt 32. The encoder 38 is formed in the servo motor 30, and the angle-of-rotation signal SA 1 corresponding to the passing speed V of a truck 28 is supplied to a control unit 56. While the engagement gear tooth 40 is formed in the upper surface at one guide rail 24, while rolls the guide-rail 24 top, the engagement gear tooth 42 which gears with the above-mentioned engagement gear tooth 40 is formed in the periphery of a driving wheel 34, and a truck 28 moves a guide-rail 24 top to angle of rotation of a driving wheel 34 by engagement of those engagement gear teeth 40 and 42 corresponding to accuracy.

[0019] The above-mentioned truck 28 has constituted the shape of a rectangular cube type, and the inspection unit 16 of a couple is equipped with the reflecting mirror 44 arranged at the position relation beforehand defined in the truck 28, a television camera 46, and ultraviolet ray lamp 48 grade, respectively, and is constituted. Flaw detection of the 2nd page is carried out simultaneously, and each reflecting mirror 44, the television camera 46, and the ultraviolet ray lamp 48 grade are symmetrically arranged to the perpendicular flat surface the inspection unit 16 of a couple turned [flat surface] to the slanting upper part among the front faces 18 of inspected material 12 and which passes along the axial center of inspected material 12. A reflecting mirror 44 is attached in the output shaft of a servo motor 50, the mirror plane 52 formed in the flat surface containing the axial center O of the output shaft is rotated by the circumference of an axial center O, and the servo motor 50 is being fixed to the truck 28 with the position in which the above-mentioned axial center O becomes parallel to the front face 18 of inspected material 12 right-angled with the longitudinal direction of inspected material 12, i.e., the migration direction of a truck 28. Moreover, a television camera 46 has the optical axis of the image pick-up lens parallel to the migration direction of a truck 28, and it is attached so that it may intersect perpendicularly with the above-mentioned axial center O, and it picturizes the pattern of the

fluorescence magnetic powder of a front face 18 by making the light from the front face 18 of inspected material 12 carry out incidence through a reflecting mirror 44. This television camera 46 is equivalent to image pick-up equipment, and outputs the picture signal SV which carries out on-the-strength change corresponding to the amount of incident light to said control unit 56.

[0020] As shown in drawing 4 , irrespective of migration of a truck 28, the above-mentioned reflecting mirror 44 is for the image pick-up range of the front face 18 by the television camera 46 to be maintained by predetermined time regularity, and the predetermined angle range appointed beforehand is rotated synchronizing with the passing speed V of a truck 28. While a servo motor 50 is operated according to the driving signal SD 2 supplied from said control unit 56 based on the passing speed V of a truck 28, the rotation angle signal SA 2 showing the rotation angle is supplied to a control unit 56 from an encoder 54. To the predetermined timing defined based on passing speed V, rotation of this reflecting mirror 44 is divided into a repeat line crack and the block of plurality [front face / 18] by this, and a sequential image pick-up is carried out. The slash of drawing 4 expresses the image pick-up range by the television camera 46, and (a) - (c) of drawing 4 is picturizing Block n by the abbreviation quiescent state irrespective of migration of a truck 28. A reflecting mirror 44 is made to carry out return rotation to the rotation location of (a), and, thereby, (d) of drawing 4 moves the image pick-up range of a television camera 46 to the following block n+1. In addition, while carrying out the horizontal scanning of this television camera 46 in the cross direction of inspected material 12, i.e., the vertical direction of drawing 4 , the vertical scanning of it is carried out to a longitudinal direction.

[0021] Said ultraviolet ray lamp 48 has a predetermined exposure range, and is attached in the truck 28 so that it may be equivalent to an exposure means and ultraviolet rays can be irradiated at all the image pick-up ranges of the television camera 46 which changes relatively to a truck 28 with rotation of the above-mentioned reflecting mirror 44. moreover -- the lower part of the ridgelines 58 and 60 of the couple located in right and left among four ridgelines which extend in the longitudinal direction of inspected material 12 -- the edge exposure lamp 62 of a couple -- the migration direction of a truck 28 -- setting -- said reflecting mirror 44 and abbreviation -- it is arranged in the same location and the edge of the ridgelines 58 and 60 in an image pick-up image is clarified by irradiating the light in ridgelines 58 and 60, respectively. In addition, it is located in both sides on both sides of inspected material 12, and the projector 64 and electric eye 66 of a couple are arranged. These projectors 64 and electric eyes 66 function as a photoelectric switch, it detects that that light is interrupted by passing the terminal 68 by the side of flaw detection initiation of inspected material 12 after a truck 28 starts migration from the initial position where the light emitted toward the electric eye 66 from the projector 64 is not interrupted, and a control unit 56 can judge now the flaw detection initiation event of inspected material 12 based on this detecting signal SP.

[0022] A control unit 56 is equipped with the microcomputer which has CPU, ROM, RAM, etc., and is constituted, and while moving a truck 28 by performing data processing and outputting said driving signals SD1 and SD2, using the temporary storage function of RAM according to the program beforehand memorized by ROM, a reflecting mirror 44 is rotated synchronizing with migration of the truck 28. Moreover, the blemish map of a front face 18 is created based on the picture signal SV supplied from a television camera 46. Hereafter, signal processing of a picture signal SV is explained concretely, referring to the flow chart of drawing 5 .

[0023] First, in step S1, if it judges whether it is the incorporation timing of a picture signal SV based on the rotation angle of a reflecting mirror 44 and is set to YES, a picture signal SV will be incorporated at step S2. The timing which incorporates this picture signal SV is set to the time amount which is picturizing the front face 18 by the abbreviation quiescent state by rotation of a reflecting mirror 44, for example, is the time amount of (a) - (c) of said drawing 4 . The flaw detection area which consists only of the front face 18 which should be carried out flaw detection out of the image pick-up image which the incorporated picture signal SV expresses with the following step S3 is set up. For example, for the range B which is the image pick-up range of the television camera 46 of the inspection unit 16 on the right-hand side of said drawing 2 , i.e., the range of the image pick-up image which a picture signal SV expresses, and is shown with a slash, the alternate long and short dash line A of drawing 6 is the range

B1 of the longitudinal direction of inspected material 12 among this flaw detection area B, although it is flaw detection area. It is beforehand set to the image pick-up image A. Moreover, range B-2 of the longitudinal direction of inspected material 12, and the right-angled cross direction A ridgeline 60 is distinguished based on signal strength change of the picture signal SV in the cross direction, and it is set according to the width-of-face size of the front face 18 beforehand set up by the setter etc. The light is irradiated by the ridgeline 60 with the edge exposure lamp 62, and since the signal strength I of a picture signal SV is changing rapidly in the portion of a ridgeline 60, a ridgeline 60 is distinguished in a high precision. At each following step, signal processing of the picture signal SV of the above-mentioned flaw detection area B within the limits is carried out.

[0024] In step S4, a picture signal SV is graduated about the longitudinal direction of inspected material 12, i.e., the longitudinal direction of drawing 6 , and a noise is removed. Inspected material 12 was rolled out by the longitudinal direction, and even if a surface crack is usually long to a longitudinal direction and smoothing is performed to a longitudinal direction as mentioned above, as for the signal resulting from a actual blemish, it is hardly influenced. The average Iav of the signal strength I of the picture signal SV in the above-mentioned flaw detection area B is computed, and the about 2 to 4-time value is set as the blemish decision threshold TH at step S6 in step S5 based on the average Iav.

[0025] At step S7, differential processing (difference processing) is performed about the cross direction of inspected material 12, i.e., the vertical direction of drawing 6 , change of the signal strength I of a picture signal SV is made steep, and an image is made sharp. At the following step S8, the signal strength I is compared with said blemish decision threshold TH, the portion of I>TH is extracted as a blemish candidate, and what is considered to be a noise with the blemish candidate's relation pattern is removed in step S9. When for example, the blemish candidate is not following the longitudinal direction of inspected material 12, this judges it as a noise, removes, at the following step S10, judges the blemish candidate after being removed as a noise to be a final blemish, and memorizes the blemish location.

[0026] By each above step, the flaw detection processing to one block of the front face 18 divided into plurality is ended. A reflecting mirror 44 is made to carry out return rotation from (c) of drawing 4 to the condition of (d), and each step, such as this, will be performed by the time it starts the incorporation of the picture signal SV of the following block. And at the following step S11, based on the detecting signal SP of said electric eye 66 etc., it judges whether all the flaw detection to one front face 18 of inspected material 12 was completed, and repeat activation of less than [step S1] is carried out until flaw detection is completed. Thereby, flaw detection processing to a front face 18 is performed for every block of drawing 4 . In addition, after incorporating the picture signal SV of all blocks, it may be made to perform flaw detection processing not more than step S3 for every block.

[0027] If all the flaw detection to one front face 18 is completed and decision of step S11 is set to YES, in step S12, the blemish map which connects the flaw detection area B of each block, and expresses the blemish location of the surface 18 whole region will be created. The flaw detection area B of each block is beforehand set up so that it may overlap mutually in the longitudinal direction of inspected material 12.

[0028] At the following step S13, an abnormality judgment of flaw detection conditions is made for the average Iav computed at said step S5 in flaw detection processing of each block, respectively as compared with mutual. Specifically the average Iav of each block is averaged, TIav is calculated, and it is judged as that to which a certain abnormalities exist in flaw detection conditions in the block below the predetermined value defined in the range whose average Iav is about 50 - 90% of TIav. the exposure conditions of ultraviolet rays [in / since the ultraviolet ray lamp 48 is attached in the truck 28 in this example / each block] -- abbreviation -- it is thought that it is the same and it is thought that distribution unevenness is in fluorescence magnetic powder. For example, inspected material 12 is arranged to location immobilization, it is thought that abnormalities, such as clogging, exist in the nozzle of a block of a portion with average value Iav low when sprinkling fluorescence magnetic powder with the nozzle of a large number similarly arranged by location immobilization, and an operator is told about abnormalities by burning of the abnormality lamp showing the block etc. When the difference of average value Iav and TIav is comparatively small, and the abnormalities of the same block continue

only the count of predetermined if needed, it may be made to perform an abnormality display.
[0029] Moreover, reference value Im with which the average TIav of the average Iav of each above-mentioned block was beforehand defined at the following step S14 An abnormality judgment of flaw detection conditions is made by whether it is small, and an operator is told about abnormalities by burning of an abnormality lamp etc. Reference value Im It adheres to fluorescence magnetic powder normally, and it is the average signal strength I, for example, about 50 - 90% of value, when the ultraviolet ray lamp 48 is irradiating ultraviolet rays correctly, and is set up in the case of a periodic check etc., and, thereby, abnormalities, such as lowering of the ultraviolet-rays reinforcement with time accompanying deterioration of an ultraviolet ray lamp 48 and concentration lowering of fluorescence magnetic powder with time, can be judged. Also in this case, when an abnormal condition continues only the count of predetermined if needed, it may be made to perform an abnormality display.
[0030] After the flaw detection equipment 10 of this this example computes the average Iav of the signal strength I of a picture signal SV at step S5 here, In order to calculate the blemish decision threshold TH based on the average Iav at step S6, and for step S8 to compare the blemish decision threshold TH and signal strength I and to make a blemish judgment, Even if it originates in change of the irrelevance and concentration of fluorescence magnetic powder, ultraviolet-rays reinforcement, etc., the optical reinforcement from inspected material 12 changes and the signal strength I of a picture signal SV changes further When the blemish decision threshold TH changes according to a change of the picture signal SV on the strength, the existence of a blemish can be judged in an always high precision.
[0031] Moreover, while dividing and carrying out flaw detection of the front face 18 of long inspected material 12 to two or more blocks in this example Since the blemish decision threshold TH is determined in quest of the average Iav of the signal strength I of a picture signal SV for every block and the existence of a blemish is judged based on the blemish decision threshold TH, For example, even when unevenness is in the irrelevance and concentration of fluorescence magnetic powder and flaw detection conditions differ in one front face 18 of one inspected material 12, flaw detection can be performed in an always high precision.
[0032] On the other hand, while making an abnormality judgment of flaw detection conditions for the average value Iav of the signal strength I in each block as compared with mutual and detecting abnormalities, such as nozzle clogging in every block, at step S13 Reference value Im beforehand determined as the average TIav of the average Iav at step S14 It compares. In order to detect abnormalities, such as lowering of the ultraviolet-rays reinforcement with time accompanying deterioration of an ultraviolet ray lamp 48, and concentration lowering of fluorescence magnetic powder with time, The abnormalities of such flaw detection conditions can be known promptly and certainly, and the reliability of equipment improves substantially conjointly irrespective of fluctuation of flaw detection conditions with the ability of flaw detection to be carried out in an always high precision. Moreover, since the large-scale monitor equipment which detects such ultraviolet-rays reinforcement, a magnetic powder spraying condition, etc. directly, and supervises them is necessarily less necessary, while flaw detection equipment 10 including magnetic powder adhesion equipment etc. is constituted compactly and cheaply as a whole, the burden of operators, such as a periodic check, is mitigated.
[0033] In this example, the portion which performs step S5 among a series of signal processing by the control unit 56 is equivalent to an operation means, the portion which performs step S6 is equivalent to a threshold decision means, the portion which performs step S8 is equivalent to a blemish decision means, the portion which performs step S13 is equivalent to a 1st abnormality decision means, and the portion which performs step S14 is equivalent to a 2nd abnormality decision means.
[0034] As mentioned above, although one example of this invention was explained to details based on the drawing, this invention can also be carried out in other modes.
[0035] For example, although the case where flaw detection was carried out was explained in said example, moving the inspection unit 16 to inspected material 12, the inspection unit 16 is fixed and you may make it move inspected material 12. Inspected material 12 is arranged to location immobilization in a dark room, with the ultraviolet ray lamp of a large number arranged by location immobilization, where ultraviolet rays are irradiated, a front face 18 can be made to be able to move a television camera 46, and

flaw detection can also be carried out to it.
[0036] Moreover, although a front face 18 is picturized according to an abbreviation quiescent state through a reflecting mirror 44 in said example, when the passing speed of a truck 28 is slow, the direct front face 18 can also be picturized with a television camera 46, without using a reflecting mirror 44.
[0037] Moreover, although said example explained the case where automatic testing of the inspected material 12 of the long picture which has a rectangular cross section was carried out, a cross-section configuration, magnitude, etc. of inspected material may be changed suitably. Of course, that you may be the case where flaw detection of the 3rd [or more] page is carried out simultaneously not only when a front face 18 carries out flaw detection of the 2nd page simultaneously, but when carrying out flaw detection only of the 1st page can also arrange two or more inspection units 16 to the 1st page.
[0038] Moreover, although an abnormality judgment is made based on the average Iav in said example while setting up the blemish decision threshold TH based on the average Iav of the signal strength I of a picture signal SV, it is also good to perform only either.
[0039] Moreover, although the about 2 to 4 times [of the average Iav] value was made into the blemish decision threshold TH in said example, the method of setting out of the blemish decision threshold TH -- add a predetermined value to the average Iav, or this scale factor computes the blemish decision threshold TH from the map to which the average Iav was beforehand set as a parameter while being changed suitably -- is defined suitably.
[0040] Moreover, although two kinds of abnormality judgments are made at steps S13 and S14 in said example, it is also good to make one of abnormality judgments. The decision value at the time of making an abnormality judgment, i.e., less than what% of the average TIav and a reference value Im, The method of setting out is defined suitably. It is a reference value Im about the average Iav in every block. That it compares and an abnormality judgment can be made etc. can define suitably the method of the abnormality decision based on the average Iav according to the adhesion method of fluorescence magnetic powder, the exposure method of ultraviolet rays, etc.
[0041] Moreover, although said example explained the case where the flaw detection area B was set up based on one ridgeline 60, it is also possible to irradiate light in the ridgeline of the vertical both sides in drawing 6 , for example, to detect the ridgeline of both sides, and to set up the flaw detection area B based on it.
[0042] Moreover, although the television camera 46 was used as image pick-up equipment in the above-mentioned example, other image pick-up equipments which output the picture signal corresponding to the amount of incident light may be used.
[0043] In addition, although instantiation is not carried out one by one, this invention can be carried out in the mode which added various modification and amelioration based on this contractor's information.

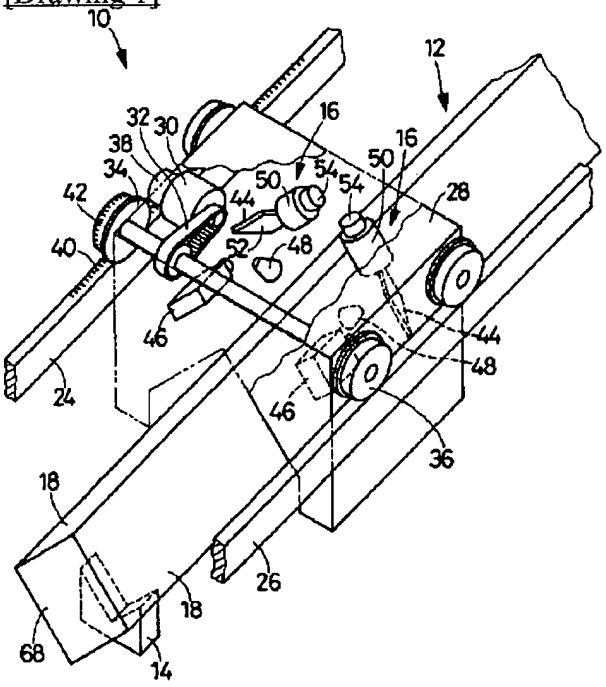
[Translation done.]

* NOTICES *

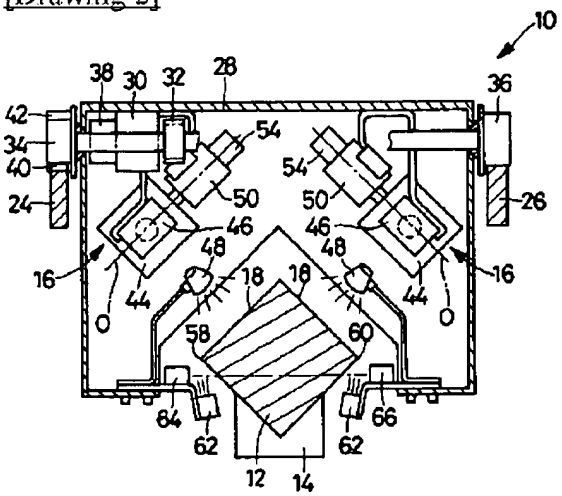
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

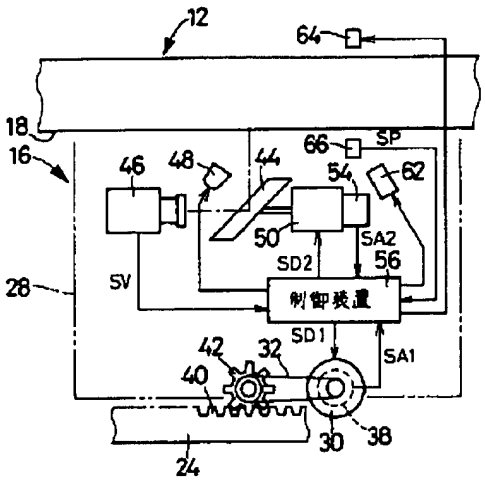
[Drawing 1]



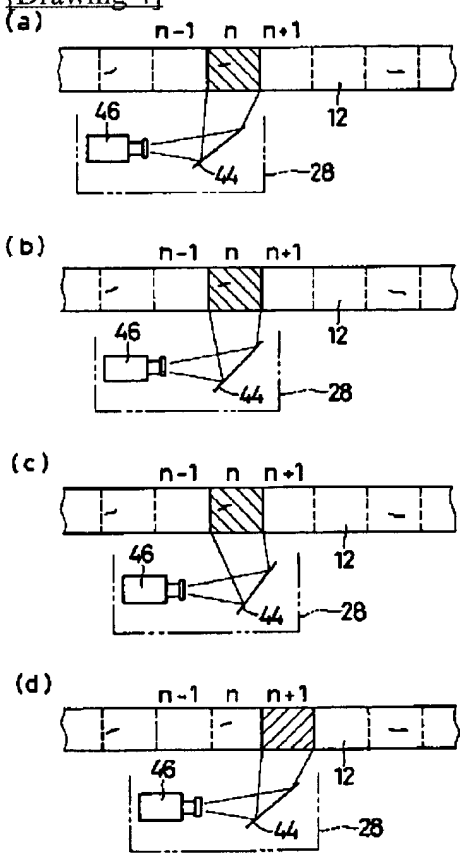
[Drawing 2]



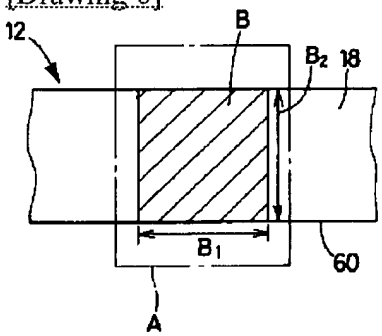
[Drawing 3]



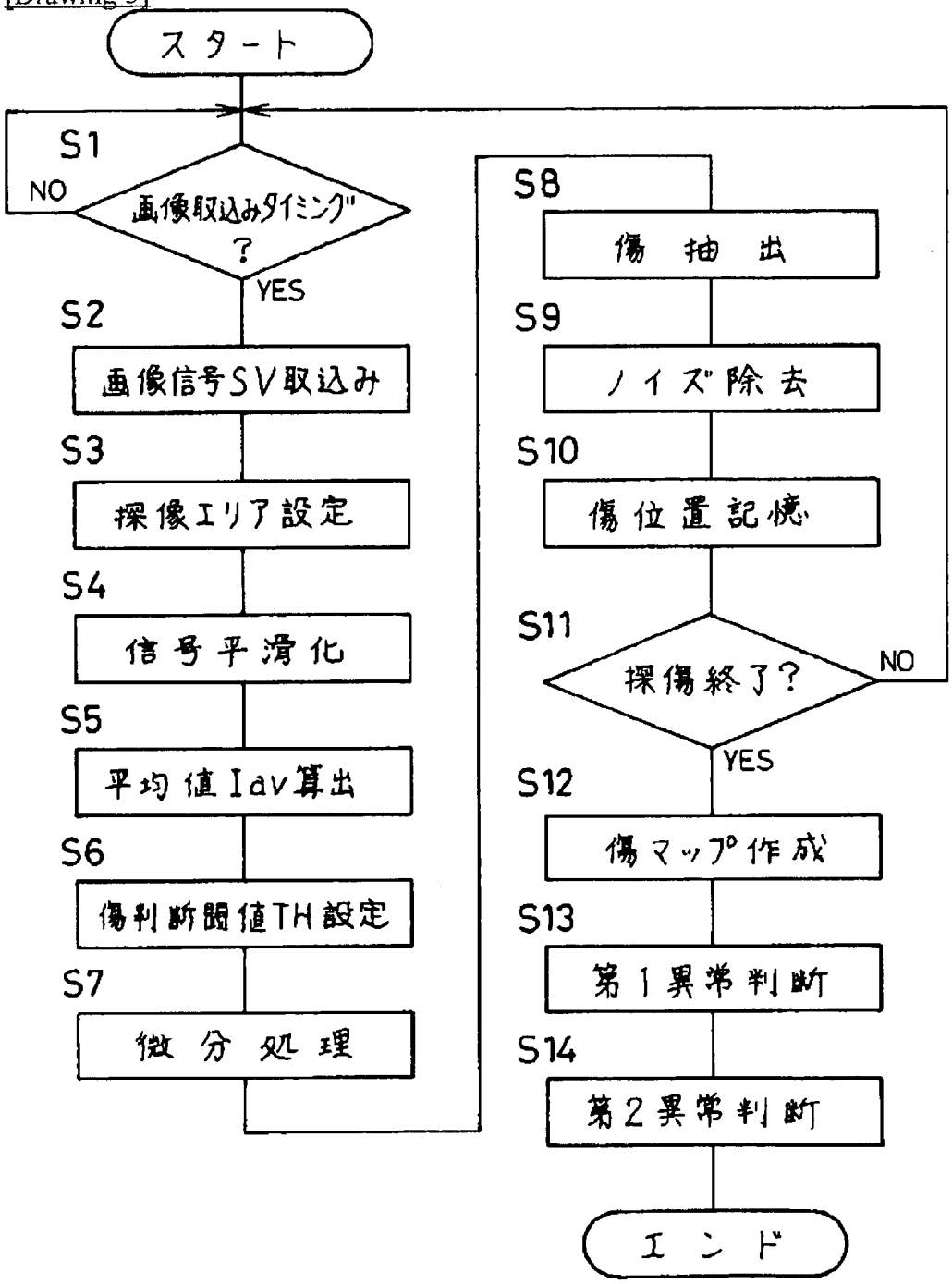
[Drawing 4]



[Drawing 6]



[Drawing 5]



[Translation done.]